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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/333,783	06/15/1999	RALPH PRINGLE JR.	970376	4506
24024	7590	10/17/2003		
CALFEE HALTER & GRISWOLD, LLP 800 SUPERIOR AVENUE SUITE 1400 CLEVELAND, OH 44114			EXAMINER MEYER, DAVID C	
			ART UNIT 2878	PAPER NUMBER

DATE MAILED: 10/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/333,783

Applicant(s)

PRINGLE, RALPH

Examiner

David C. Meyer

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 July 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 7-10 is/are rejected.
- 7) ☒ Claim(s) 2-6 and 11-15 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Claim Objections*

1. Claim 10 has been amended to overcome the objection due to improper antecedent basis; the objection is withdrawn. Also, the examiner thanks the applicant for correcting the dependency errors in claims 11 and 13.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Cochran (US 4,750,818). Cochran discloses a method of operating an adaptive optics system, the system comprising a deformable mirror **30** that is illuminated with optical energy, a phase shifter array **24** having a plurality of actuators **28**, a wavefront sensor (detector array **22**) having subapertures, and a processor (digital means **32**) that processes wavefront slope measurements and generates commands for controlling the actuators. The processor performs a matrix multiplication function wherein an estimation matrix multiplies wavefront slope data in order to generate actuator commands for deforming portions of mirror **30**. The estimation matrix is employed to “maximize performance assuming certain systems and environmental conditions” and may be used to calibrate for weather effects or intensity (amplitude) fluctuations. The estimation

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matrix, therefore, accommodates a slope weighting function. (See column 4, line 16 to column 6, line 20.)

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cochran (US 4,750,818). Cochran does not disclose that deformable mirror **30** is controlled by 941 actuators. Absent any showing of criticality, the specific number of actuators employed would have been obvious to one of ordinary skill in the art at the time of invention in view of the desired performance and system cost.

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cochran (US 4,750,818) in view of Rather et al (US 4,825,062). Cochran does not disclose for each subaperture a corresponding plurality of actuators. Rather et al teaches an adaptive optics system comprising a wavefront sensor having a plurality of subapertures which correspond one-to-one with segments **44** of a deformable mirror **40** (column 9, lines 37-40). Rather et al discloses that each mirror segment is controlled by a plurality of actuators **54,56,58** (column 4, lines 57-64). The specific number of actuators associated with each subaperture would have been obvious to one of ordinary skill in the art at the time of invention in view of the desired performance and system cost.

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7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cochran (US 4,750,818) in view of Wisner et al (US 4,217,355). Cochran does not disclose a servo compensator for controlling the actuators. It is well known to use a servo control system in conjunction with an adaptive optics system as taught by Wisner et al. Wisner et al discloses an adaptive optics system comprising a servo control system **44** that receives an electrical signal from a radiation detector **36** and outputs correction signals **52** to actuators **20** disposed on the back surface of a deformable mirror **32**. It would have been obvious to one of ordinary skill in the art at the time of invention to employ a servo compensator to control the actuators in order to achieve a reliable and accurate system control.

***Allowable Subject Matter***

8. Claims 2-6 and 11-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: Regarding claims 2-6 and 11-15, the prior art of record does not disclose calculating the average of the amplitudes detected in the wavefront sensor's subapertures or using an average amplitude to perform a weighting function.

***Response to Arguments***

9. Applicant's arguments filed July 3, 2003 have been fully considered but they are not persuasive. In regard to the rejection of claims 1 and 10 under 35 U.S.C. 102(b) under Cochran, the applicant argues the following:

1. The calculation of actuator commands involves a preparation step and a solve step. During the preparation step, a matrix is prepared based on the movement of actuators and measurements of wavefront sensors. During the solve step, a transpose of this matrix is multiplied by slope data from the wavefront sensors to generate actuator commands.
2. The preparation stage is performed infrequently and upon a substantial change in the sensor, actuator array, or atmosphere.
3. Cochran suggests using the matrix approach described above to deal with scintillation (spatial variations in amplitude), but Cochran realizes this is possible because the matrix prepared during the preparation step is "sparse".
4. Independent claims 1 and 10 recite the determination of both slope data and amplitude data received by each subaperture, whereas Cochran teaches only the determination of slope data based on received optical energy. Furthermore, claims 1 and 10 recite a slope weighting function based on slope and amplitude data, whereas Cochran uses slope data only.

The examiner does not contest 1. Regarding 2, Cochran teaches that the matrix calculated during the preparation step can be changed in *real time* (column 5, lines 64-67). Later, Cochran states that recalculation may be performed "on a *millisecond basis* in order to deal with scintillation, the variation of the intensity of the light ..." (emphasis

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added, column 6, lines 8-12). Regarding 3, Whether this recalculation is possible only because the matrix being calculated is "sparse" has no bearing on whether Cochran anticipates the instant invention, because claims 1 and 10 do not recite limitations to this end. Regarding 4, the examiner maintains that Cochran does anticipate the feature of receiving slope and amplitude data in the subapertures of sensor 22. Where else but at wavefront sensor 22 would scintillations (variations in intensity, or amplitude) be detected? The examiner further maintains that Cochran anticipates the feature of weighting based on amplitude and slope data. Cochran controls the actuators based on the multiplication of a slope data matrix  $s$  and the transpose of prepared matrix  $H$ . But  $H$  is recalculated "on a millisecond basis" to provide for intensity variations. Hence, both slope and amplitude data are used to perform slope weighting.

In view of the foregoing, all of the previous rejections under 35 U.S.C. 102(b) and 35 U.S.C. 103(a) are upheld.

### ***Conclusion***

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David C. Meyer whose telephone number is 703-305-7955. The examiner can normally be reached on M-F 8:30-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David P. Porta can be reached on 703-308-4852. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0935.

DCM  
September 22, 2003



**DAVID PORTA**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**